CDF to D0 Luminosity Ratio

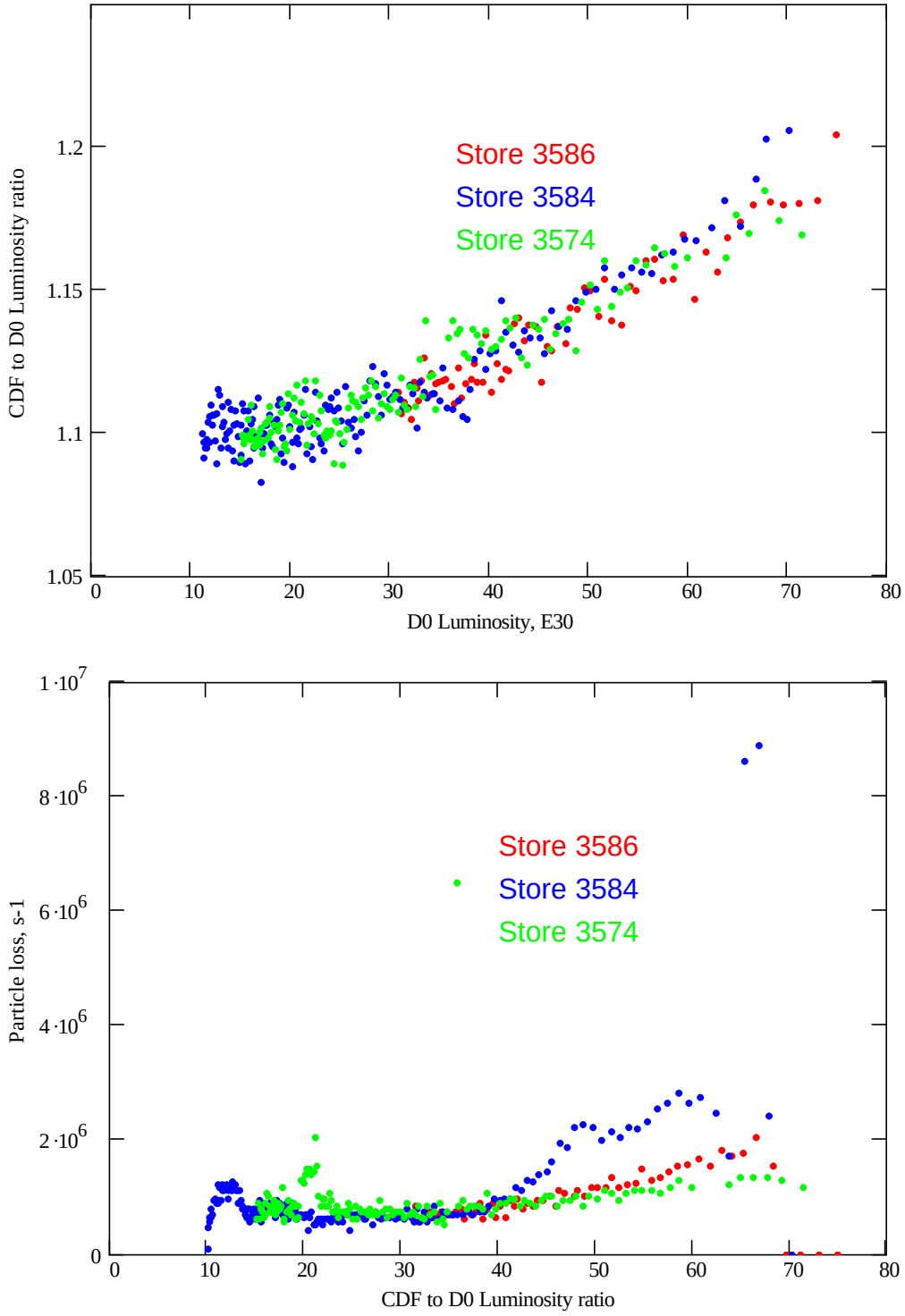
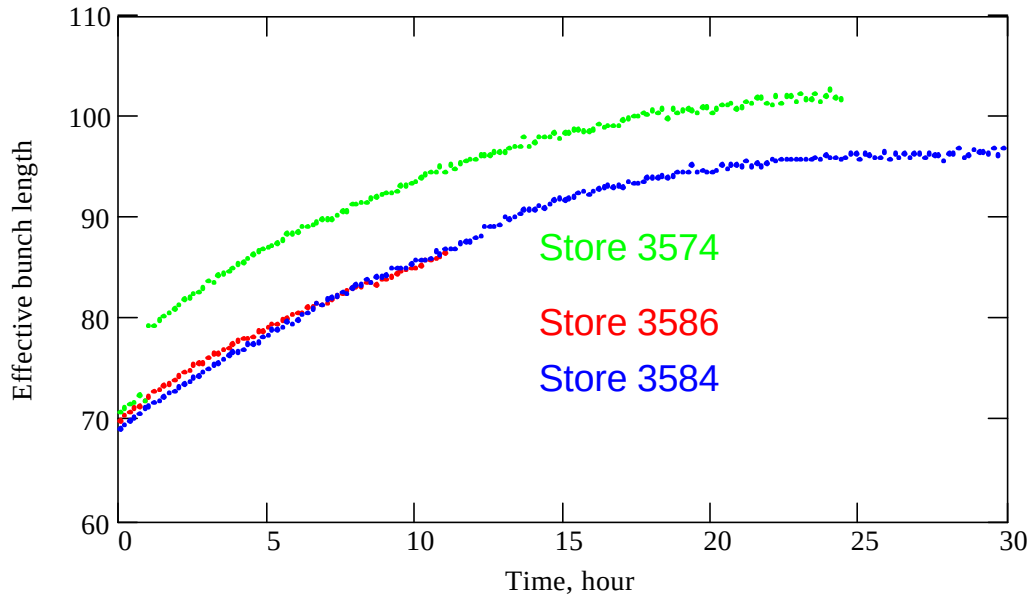


Figure 1

- CDF to D0 luminosity ratio grows almost proportionally to the luminosity
- There is weak correlation between the beam loss and the luminosity ratio
  - Large beam loss at the beginning of Store 3584 contributed ~1% to the luminosity ratio



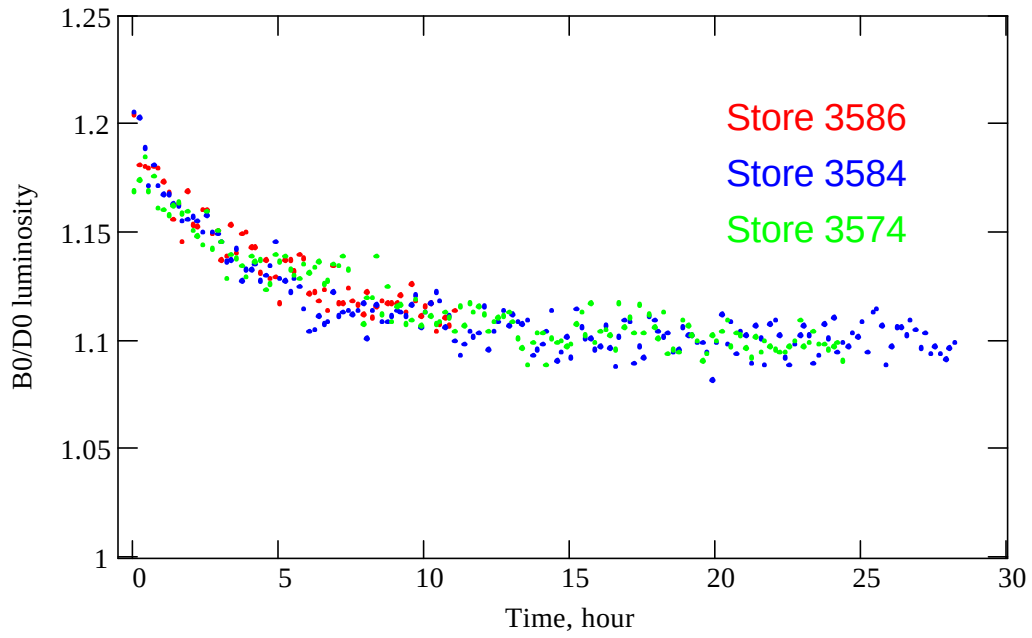


Figure 2

- There is no direct correlation between effective bunch length, $s = \sqrt{s_a^2 + s_p^2}$ and CDF to D0 luminosity ratio
  - Because of cavity trip at the beginning of Store 3574 the effective bunch length jumped from 72 to 79 cm but it did not cause any changes in luminosity
    - As one can see from above plots expected value for the jump of luminosity ratio is ~0.03 and is much larger than the measurement noise

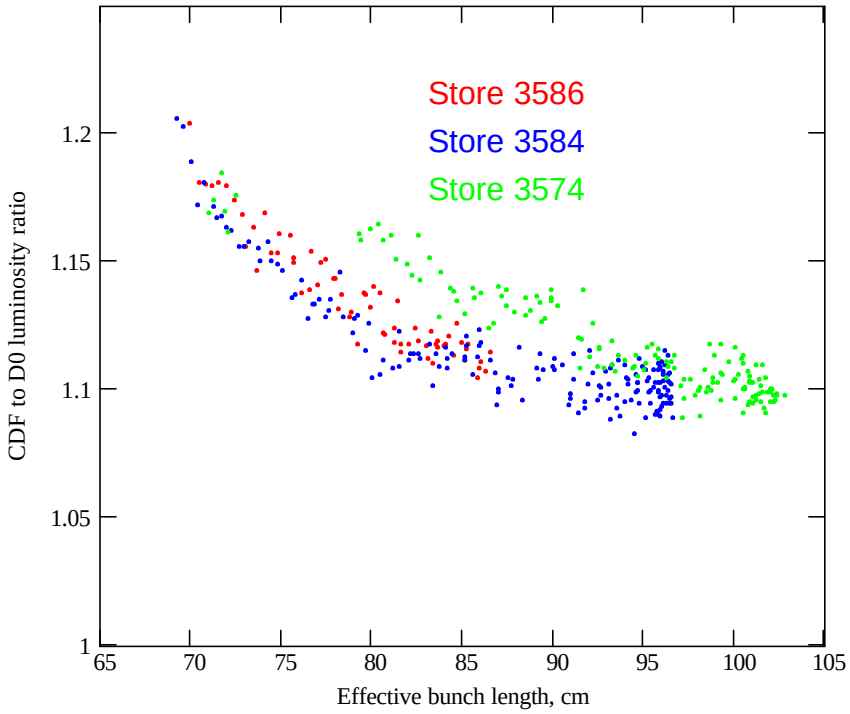


Figure 3

The picture on the left presents the luminosity ratio as function of the effective bunch length for different stores. Poor correlation of the luminosity ratio as function of bunch length signals that it is rather improbable that the hourglass effect is the major contributor to the changes in the luminosity ratio. The correlation is much better if the ratio is plotted as function of the luminosity (see Figure 1).

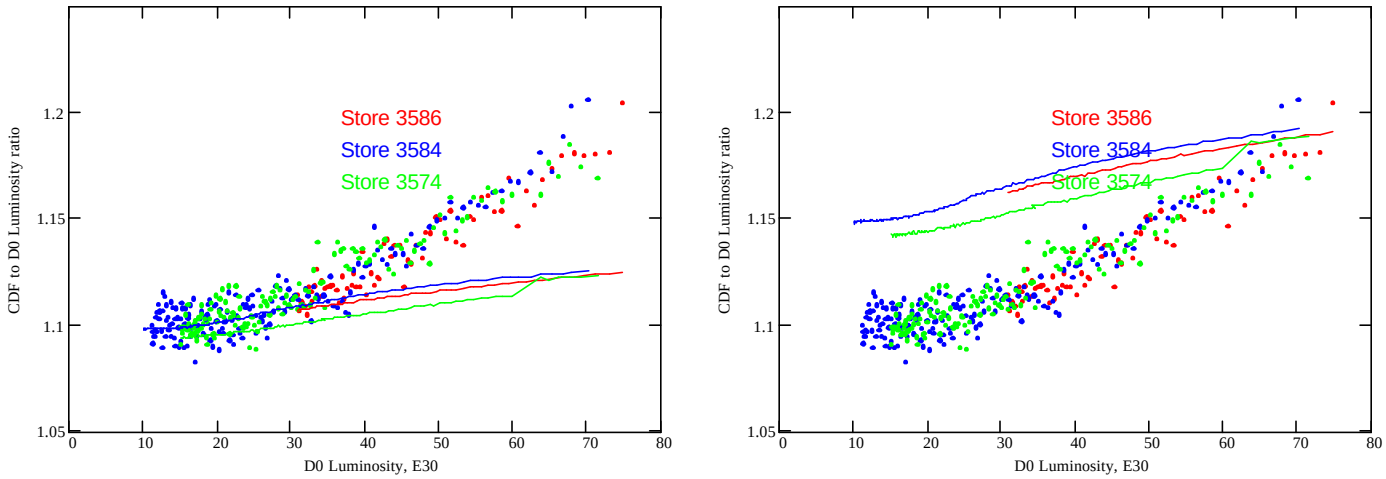
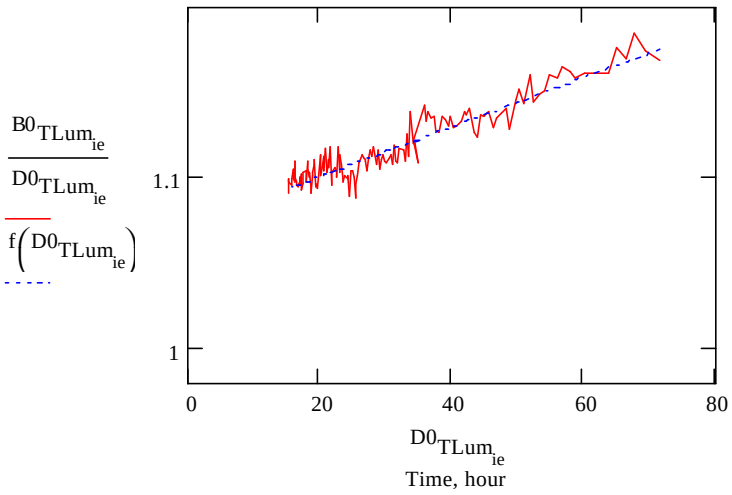


Figure 4

- If we try to match luminosities at the end of the store using different beta-functions for CDF and D0, than their ratio has to be 27.5/35 but the slope of the curve (due to hourglass effect) is 5 times smaller of the measured (see picture on the left). If we try to match luminosities at the store beginning, than the beta-function ratio has to be 27.5/40 but the slope of the curve is still 3 times smaller than the measured one (see picture on the right). Optics measurements carried out at Low beta exclude the second possibility (ratio 27.5/40) and leave very little chance that the first ratio could happen. That points out again that the hourglass effect is not responsible for changes of luminosity ratio during a store.

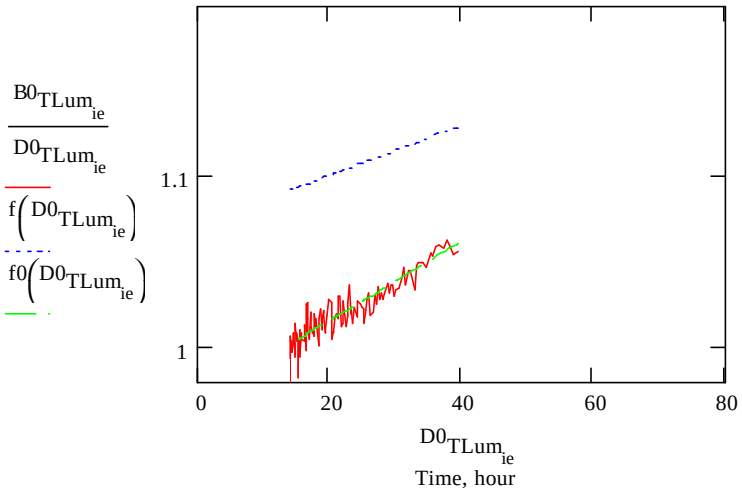
Comparison of Luminosity ratio to the stores one year ago

$f(x) := 1.072 + .00145 \cdot x$



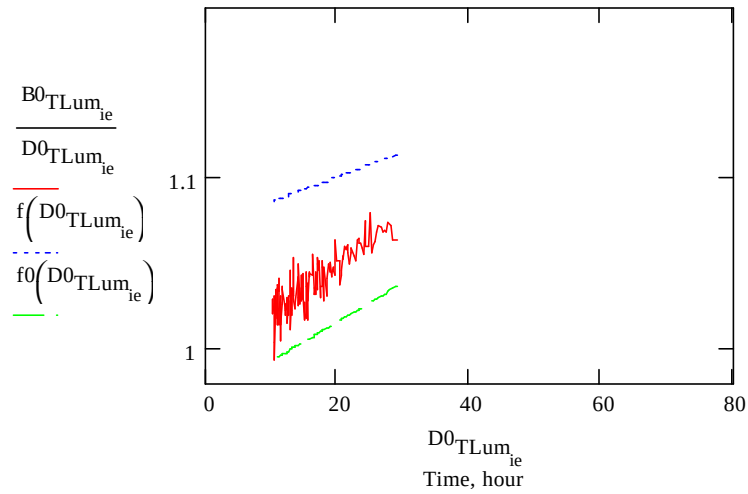
Store 3574

$f(x) := 1.072 + .00145 \cdot x$ $f0(x) := 0.97 + 0.0023 \cdot x$



Store 2328

$f(x) := 1.072 + .00145 \cdot x$ $f0(x) := 0.97 + 0.0023 \cdot x$



Store 2138

The pictures on the left show the luminosity ration for a recent store and two stores more than year ago. One can see that one year ago the ratio was changing even faster with luminosity but due to smaller luminosity the total change was close to the presently observed.

Conclusions

- It is impossible to explain the changes in CDF to D0 luminosity ratio by hourglass effect
  - Imperfect aiming of the beams in IPs could cause similar effect but all the indications we have point out that there is good aiming of the beams
- Most probable the difference in the luminosity and its dependence on time is a problem with the luminosity measurement itself.
- Accelerator diagnostics are not accurate enough to make a definite statement which of two luminosity monitors is functioning improperly
- Tevatron and Integration departments will continue investigations to point out the details to the problem but it is clear that we need to look much more thoroughly on the detector side